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KEY TO THE MALESIAN SPECIES OF *LEPTOGOMPHUS* SELYS, WITH THE DESCRIPTION OF A NEW SPECIES FROM SABAH (ODONATA, GOMPHIDAE).

Descriptions and records of Malesian Odonata, 1.

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A new species of *Leptogomphus*, *L. pasia*, based on one female from S. Sabah (Northern Borneo), is described. A congeneric and presumably conspecific male from E. Sabah is also described. A key to the eleven species of this genus recorded from Malaysia, Indonesia, the Philippine Islands, and the adjacent areas in Burma and Thailand, is included. Many characters are illustrated for the first time.

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Key words. — Leptogomphus; key; Malesia; new species.

INTRODUCTION

During the 1987 expedition of the Rijksmuseum van Natuurlijke Historie (Leiden) to Sabah, northern Borneo, a wealth of interesting Odonata was collected. In this paper a new species of *Leptogomphus* Selys is described, based on a single female. It was collected in the vicinity of Long Pasia, a village still surrounded by vast areas of virgin rainforest. This area, situated close to the borders of Sarawak and Kalimantan at c. 1000 m above sea level, is poorly investigated for the aquatic fauna up to now. The Odonata fauna seems to be most closely related to those of Mount Dulit and other higher peaks in Sarawak. This may be exemplified by records of *Coeliccia cyaneothorax* Kimmins, formerly only known from Mt. Dulit, and *Burmagomphus insularis* Laidlaw, of which only the holotype from Sarawak was known. A complete list of the species encountered will be published in due time.

SYSTEMATIC PART

Leptogomphus pasia spec. nov. (Figs. 1-6, 8, 16, 32-33)

Type material. — Holotype female: 'RMNH Leiden/N. Borneo, S. SABAH. Beaufort, 105 km S of: Long Pasia area. Sungai Pasia near confluence with Sungai Maga. Rockpools and stream. Lower montane evergreen tropical rainforest. 1250 m. 4°26'N 115°40'E. 3 April 1987. Leg. C. van Achterberg', in Museum Leiden (RMNH).

Other material. — Sabah, 60 km W of Lahad Datu: Danum Valley Field Centre, 4°58'N 117°48'E. 2 May 1987, 1 male (J. van Tol) in RMNH.

Description

Female. — Closely related to *Leptogomphus lansbergei* and *L. semperi*, but immediately recognizable by its extremely long vulvar lamina (vulvar scale) (authors of species-group names in *Leptogomphus* are given in table 1).

Head. — Depressed; frons, clypeus and labrum protruding. Labium with prementum dark brown to brownish black, lateral lobes greenish yellow, broadly bordered with brownish black, especially distally; movable hooks brownish black, central part of mentum pale brown, laterally bordered with creamish white. Mandibles reddish brown-black, but visible part beside the labrum mostly greenish yellow. Labrum black with two relatively small subtriangular pale spots close to the clypeus. Clypeus black, with a paired oval depression on postclypeus, together approximately as wide as clypeus between the emarginate anterior side. Frons distinctly swollen with a broad greenish yellow transversal stripe, covering nearly half of the surface, pale stripe interrupted in the middle by a dark triangular

Table 1 Species included in the key of the *Leptogomphus* species of Malesia, with original references

Species	Author; date: pages	Original genus	Type depository
L. coomansi	Laidlaw 1936: 267-269	Leptogomphus	RMNH / H male
L. gestroi	Selys 1891: 476-477	Leptogomphus	MCSN / H male
L. inclitus	Selys 1878: 444 (sep 39)	Gomphus (Leptogomphus)	BMNH / L female
L. lansbergei	Selys 1878: 446 (sep 41)	Gomphus (Leptogomphus ?)	IRSN + SMTD / S female
L. lansbergei assimilis	Krüger 1899: 308	Leptogomphus	ZMPA ? / S male + female
L. mariae	Lieftinck 1948: 249-251	Leptogomphus	RMNH / H female
L. palawanus	Asahina 1968: 364-365	Leptogomphus	CASC / H male
L. pendleburyi	Laidlaw 1934: 555-556	Leptogomphus	BMNH / H male
L. risi	Laidlaw 1933: 95-96	Leptogomphus	BMNH / H male
L. semperi	Selys 1878: 443 (sep 38)	Gomphus (Leptogomphus)	IRSN / H male
L. williamsoni	Laidlaw 1912: 94-95	Leptogomphus	BMNH / H male

Abbreviations: BMNH = British Museum (Natural History), London; CASC = California Academy of Sciences, San Francisco; IRSN = Institut Royal des Sciences Naturelles de Belgique, Bruxelles; MCSN = Museo Civico di Storia Naturale, Genoa; RMNH = National Museum of Natural History, Leiden; SMTD = Staatliches Museum für Tierkunde, Dresden; ZMPA = Zoological Museum Polish Academy of Sciences, Warszawa. – H = holotype, L = lectotype, S = syntype.
Note: The type of *L. assimilis* should be selected from material in the Dohrn collection, which was deposited in Stettin (now Szczecin, Poland); some parts of the collection of this museum have been transferred to ZMPA.

emargination. Vertex shiny black, but dullish black behind the tubercles posterior to the lateral ocelli; occiput also dull black, tubercles behind lateral ocelli consisting of a larger pair in the centre between the ocelli and a smaller pair latero-posteriorly of the former; occiput without tuberculi (fig. 2), which are usually present in congeneric species (e.g. L. *semperi*, *L. coomansi*, *L. mariae* and *L. williamsoni*) (see also Lieftinck 1948, plate 8); occiput posteriorly with a distinct triangular emargination.

Thorax (for nomenclature of thoracic markings, cf. Williamson 1907: fig. 29 (1)). – Prothorax with anterior lobe erect, black, but greenish yellow in lateral edges; middle lobe with deep median depression anteriorly. Synthorax (fig. 5) brownish black with pale markings yellow; dorsal thoracic stripe connected with mesothoracic half collar (as in *L. coomansi*); antehumeral stripe narrow, somewhat wider at posterior side; pale markings on mesepimeron and metepisternum more or less as in *L. lansbergei*, but pale area on metepimeron much smaller than in *L. lansbergei* (the dark stripe under the pale area approximately of equal width). Legs stoutly built; hind femora with two rows of 9-12 distinct short spines on innerside; all tibiae with two rows of 9-10 long spines on innerside. Wings: forewing 37 mm, hind wing 35 mm. Forewing with 16 Ax and 13 Px; hindwing with 12 Ax and 13 Px. Hind wing with one cubito-anal crossvein; an incomplete crossvein proximal to first primary Ax present; distal costal brace closer to proximal costal brace than to nodus; triangle, supratriangle and subtriangle all without crossveins. Pterostigma 3.5 mm.

Abdomen. — Length 39 mm. Dark brown, nearly black, except for a yellow middorsal stripe, which is rather wide on segments 1-2, but much narrower to nearly indiscernable on segments 3-8; lateral side of segment 1 dark yellow, lateral side of segment 2 and antero-lateral side of segment 3 also dark yellow. Auriculae hardly developed, yellow. Vulvar lamina diagnostic (figs. 3-4), extremely elongate, the tip reaching posterior margin of segment 10, very slender, the top acutely v-shaped.

Male. – As female (figs. 6, 16), but pale spots on labrum larger than in female, subquadrangular (fig. 8); hind femora with many short spines on innerside instead of the rows of medium-sized spines as in the female; wings with anal triangle three-celled, crossveins meeting in one point; secondary genitalia and anal appendages very similar to *L. lansbergei*, but superior appendage of *lansbergei* in dorsal view curved outwards more conspicuous than in *pasia* (figs. 30, 32); base of superior appendage of *pasia* bulgy on outer margin; consequently, lateroventral ridge with spines along the outer margin of the superior appendage nearly straight in *lansbergei* and distinctly curved in *pasia* (figs. 31, 33).

Although I consider this male conspecific with the female described above, I prefer to include only the female in the type series of this species.

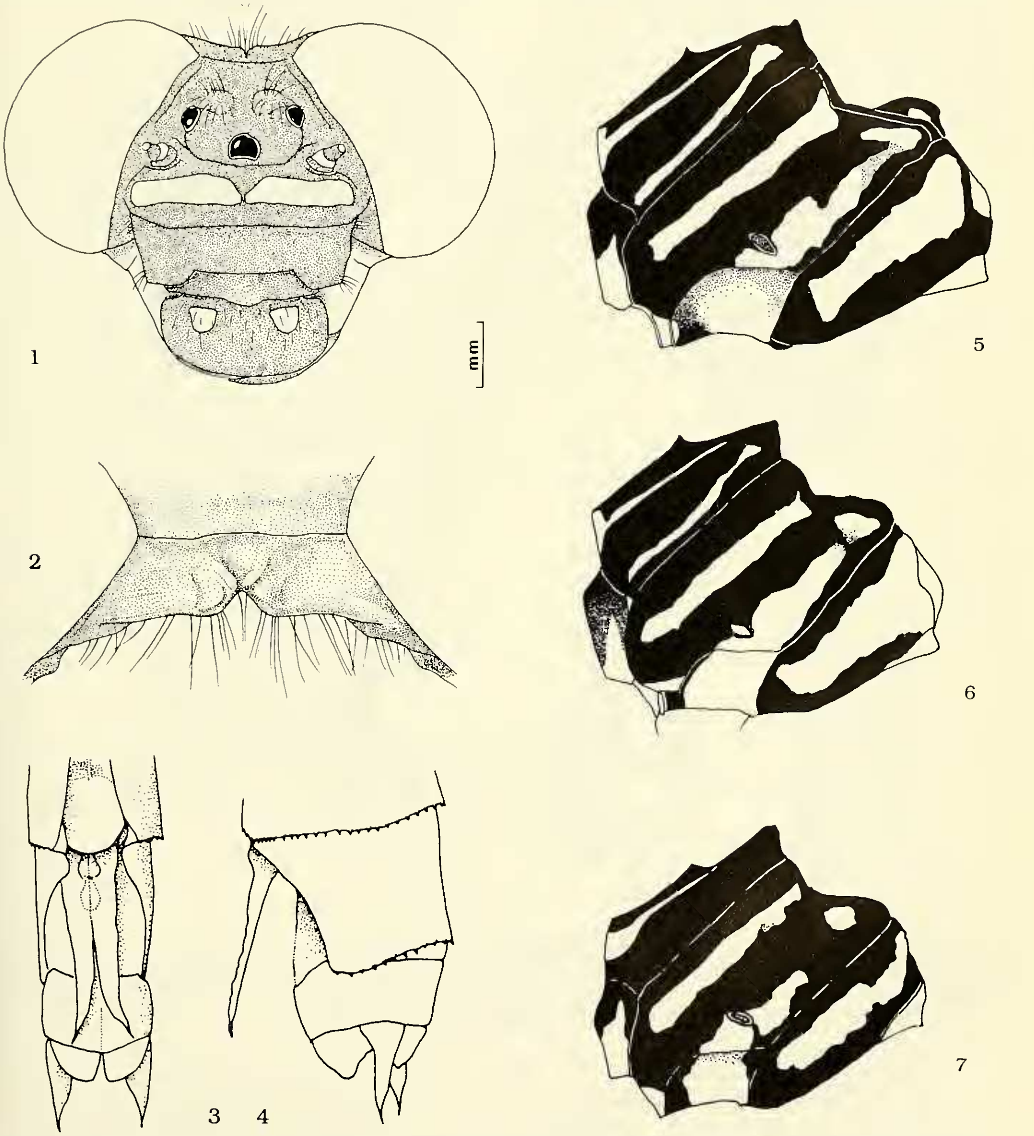
Differential diagnosis. – The female of this species, superficially looking as *L. lansbergei*, is most easily distinguished from its congeners by the peculiar shape of the vulvar lamina. Also the male is very similar to *L. lansbergei*, but can be distinguished from most species by the thoracic markings, and from *lansbergei* by the shape of the superior appendages.

Etymology. – Pasia from the type locality Long Pasia. To be considered as a noun in apposition.

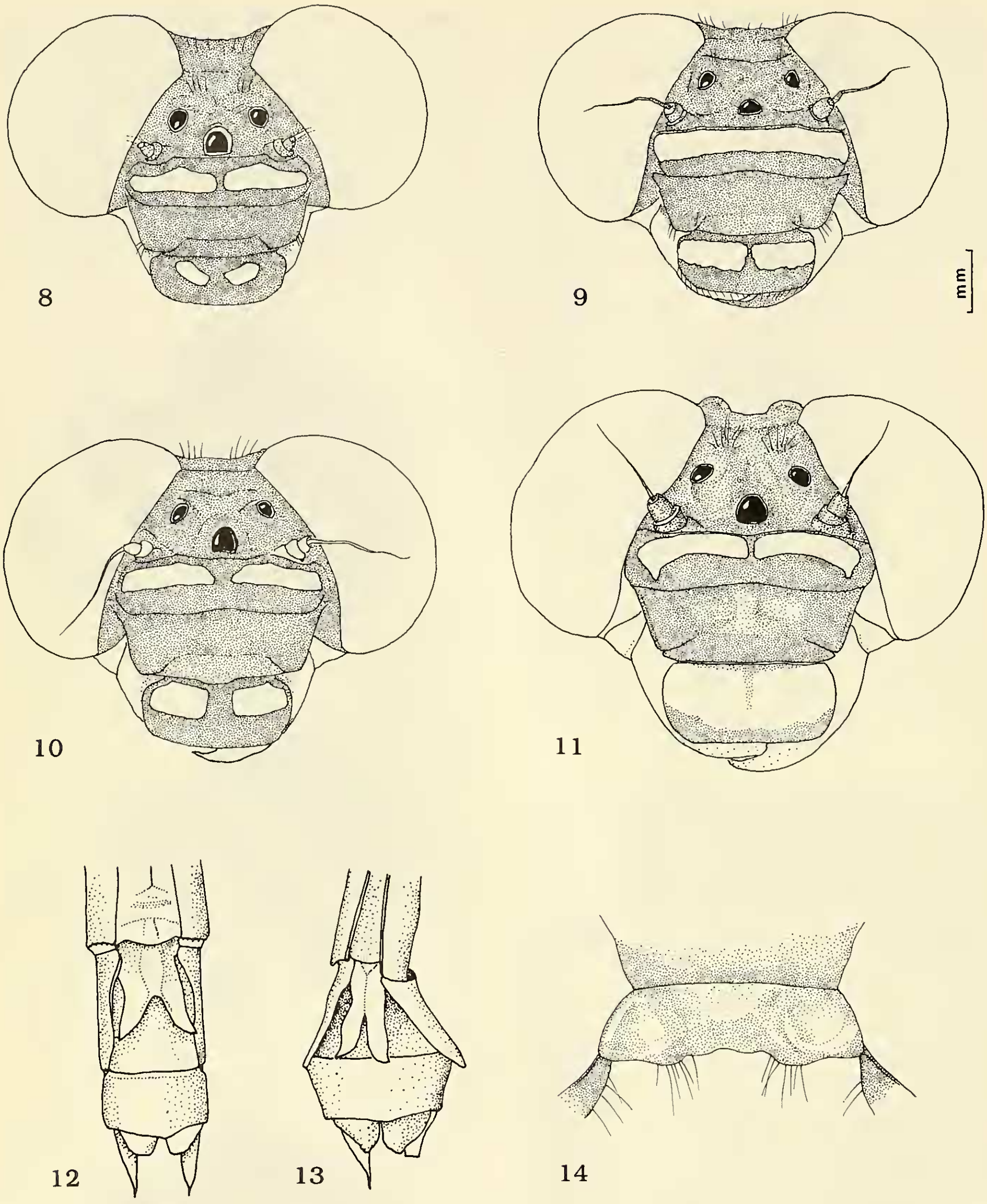
Discussion

Up to now the following species of the genus *Leptogomphus* were known from Borneo: *L. coomansi*, *L. mariae*, *L. pendleburyi* and *L. williamsoni*. There is still some doubt about the occurrence of *L. lansbergei assimilis* on Borneo, of which a male was recorded from Bettotan, 4 August 1927 by Laidlaw (1931). This specimen is not in the collection of the British Museum (Natural History) (Brooks in litt.). Also *L. semperi*, known from Mindanao, should be taken into account when considering the fauna of Borneo. Earlier records by Martin (1904) and Williamson (1907) were considered erroneous by Laidlaw (1936). This species was also attributed to the *lansbergei* Formenkreis by Laidlaw (1936).

L. pasia shows some affinity to *L. coomansi* and *L. mariae*, sharing the connection between the dorsal stripe and the mesothoracic half collar (cf. Lieftinck 1948, plate 8). The absence of spiny tubercles on the occipital plate, and the peculiar shape of the



Figs. 1-7. *Leptogomphus* from northern Borneo. – 1, *L. pasia* female holotype, head in frontal view; 2, Idem, hind margin of occiput in dorsal view; 3-4, Idem, last abdominal segments in ventral and left lateral view; 5, Idem, synthorax in left lateral view; 6, *L.* cf. *pasia*, male from Danum Valley, synthorax in left lateral view; 7, *L. pendleburyi*, male holotype, synthorax in left lateral view.



Figs. 8-14. *Leptogomphus*. – 8, *L.* cf. *pasia*, male from Danum Valley, head in frontal view; 9, *L. pendleburyi*, male holotype, idem; 10, *L. lansbergei assimilis*, male from S. Sumatra, idem; 11, *L. inclitus*, female lectotype, head in frontal view; 12, *L. lansbergei assimilis*, female from S. Sumatra, last abdominal segments in ventral view; 13, *L. inclitus*, female lectotype, idem; 14, *L. inclitus*, female lectotype, hind margin of occiput in dorsal view.

vulvar scale are diagnostic characters for the presently described species. As already mentioned above, it is, however, most closely related to *L. lansbergei* from Java and Sumatra.

KEY TO THE *LEPTOGOMPHUS* SPECIES OF MALESIA

In the next key I have summarized the characters to distinguish the species of *Leptogomphus* occurring in Malesia (i.e. the Malay peninsula, Indonesia, the Philippine Islands and the island groups northeast of New Guinea). I have added several species recorded from Burma and Thailand that might occur in this area. All species mentioned in the key are listed in table 1 with the author and a reference to the original publication. *Leptogomphus svihleri* Asahina, however, recorded from Burma and Thailand, is not included in the key. The absence of an incomplete basal cross-vein (Asahina 1970: 116) is an indication that this species is not a *Leptogomphus* in the present sense. Asahina (1986: 17) has placed it in *Heliogomphus*. The genus *Leptogomphus* Selys as defined by Carle (1986) forms with *Africogomphus* Fraser and *Heliogomphus* Laidlaw the tribe Leptogomphini in the Epigomphinae. Characters to distinguish *Leptogomphus* and *Heliogomphus* include lamina on fore tibia of male (present/absent, respectively), basal subcostal crossvein (present/absent), cells of anal triangle in male (meet in one point/serially), lamina anterior (raised transverse-platelike/bilobate), superior appendages of male (more or less straight/lyrelike).

The key is mainly based on characters in the markings of the specimens, predominantly of the head and the thorax. Colour pattern is a reliable character in this group and the interpretation of conspecificity is based on this character for several species. Structural characters include the appendages of the male and the vulvar scale of the female. Also the tubercles on vertex and occiput are frequently used, but these characters have to be considered carefully. I have seen several specimens with very apparent differences in the tubercles on each side of the head. Asahina (1986: 22) mentions female specimens of *L. gestroi* Selys with an occipital structure significantly different from the (allo) type. This phenomenon was also observed by him in *Merogomphus parvus*.

The distribution of the species was taken from the following works: for India in the wider sense (Laidlaw 1922, Fraser 1927, 1934), for Thailand (and Burma) (Williamson 1907, Asahina 1986), for Sumatra (Krüger 1899, Ris 1927, Lieftinck 1935, 1948), for Java (Lieftinck 1934), for Borneo (Laidlaw 1912, 1914, 1934, 1936, Lieftinck 1948) and for the Philippine Islands (Needham & Gyger 1937, Asahina 1968). Lieftinck (1954) is a most useful summary of knowledge for the larger part of this area.

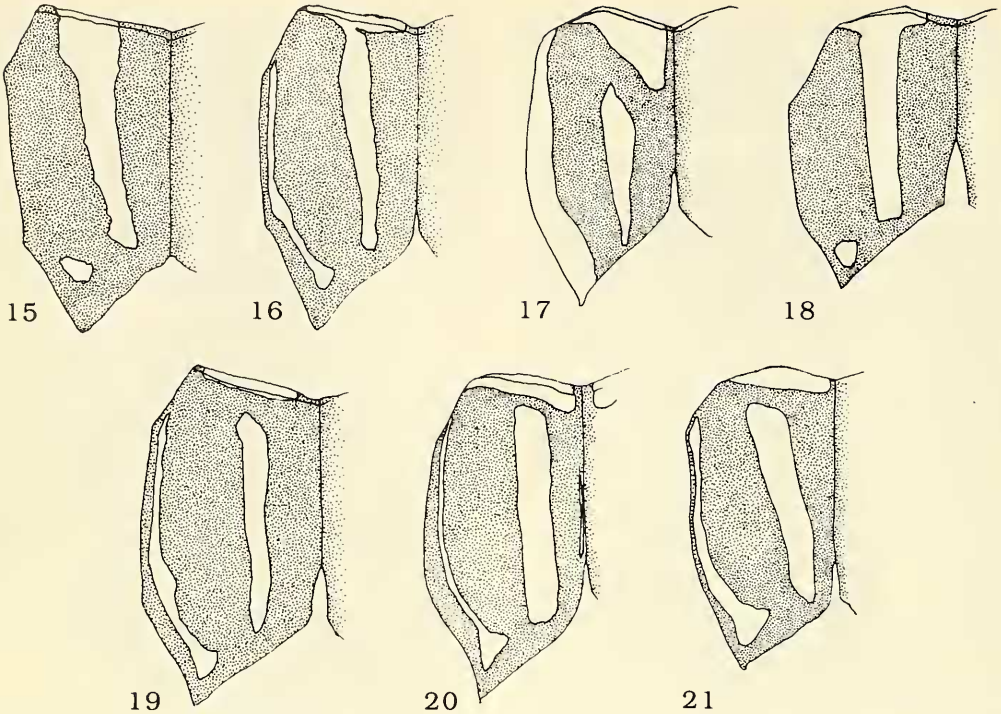
Table 2 provides a data matrix for several important characters used in the dichotomous key below. I have examined all species myself.

1. Thorax with complete antehumeral stripe running close to the humeral suture (e.g. figs. 16-17, 19-21) 2
— Antehumeral stripe on thorax absent or strongly reduced, usually to a small pale spot in the posterior corner of the thorax above the humeral suture (e.g. figs. 15, 18) 10
2. (1) Vertex with yellow marking; transversal stripe on frons not interrupted by a longitudinal black line in the middle 3

Table 2

Species	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
coomansi	+	+	—	+	—	—	—	+	+
gestroi	+	—	—	—	+	+	—	?	—
inclitus	+	—	+	—	—	+	—	±	?
lansbergei lansbergei	+	—	+	—	—	+	—	—	+
lansbergei assimilis	+	—	+	—	—	+	—	—	+
mariae	+	+	+	—	—	r	—	+	?
palawanus	+	+	±	—	—	r	—	+	+
pasia	+	+	±	—	—	+	+	—	(+)
pendleburyi	+	+	—	—	—	r	?	?	+
risi	+	+	+	—	—	—	—	—	±
semperi	+	+	+	—	—	+	—	+	+
williamsoni	—	±	—	+	+	+	—	+	?

(1) Dorsal stripe complete (+) / incomplete (—)
(2) Dorsal stripe connected (+) / not connected (—) with mesothoracic half collar
(3) Yellow mark on frons separate (+) / one stripe (—)
(4) Anterior side of postclypeus with yellow patches (+) / dark (—)
(5) Yellow mark on vertex present (+) / absent (—)
(6) Antehumeral stripe present (+) / absent (—) / reduced (r)
(7) Valve (female) far beyond segment 9 (+) / shorter (—)
(8) Tubercles on occiput in female present (+) / absent (—)
(9) Tubercles on abdominal segment 10 of male present (+) / absent (—)



Figs. 15-21. – Thoracic pattern of left half of *Leptogomphus* species, dorsal view. – 15, *L. pendleburyi*, male holotype; 16, *L.* cf. *pasia*, male from Danum Valley; 17, *L. williamsoni*, female E. Borneo; 18, *L. coomansi*, male E. Borneo; 19, *L. lansbergei assimilis*, male S. Sumatra; 20, *L. gestroi*, male Thailand, Doi Suthap; 21, *L. inclitus*, female lectotype.

— Vertex black, without yellow or otherwise pale markings; transversal stripe on frons interrupted by a longitudinal black line in the middle (cf. figs. 8, 10, 11) 4

3. (2) Characteristic markings on thorax with very short dorsal stripe and large mesothoracic half collar (fig. 17). Occiput black. Postclypeus with latero-anterior corners pale coloured. Distribution: Borneo. .... *L. williamsoni* Laidlaw

— Markings on dorsal side of thorax less characteristic, with a mesothoracic half collar as in most other congeneric species and a complete dorsal stripe, which is not connected with the mesothoracic half collar (fig. 20). Occiput with a pale centre. Postclypeus brown, without pale markings. Superior appendages of male, figs. 22-23. Distribution: Thailand, Burma. .... *L. gestroi* Selys

Note. Redescription of male and female with illustrations in Lieftinck (1960: 238-240, fig. 6).

4. (2) Males 5

Note. The male of *L. inclitus* (distribution Thailand) is unknown. See fig. 21 for the thoracic markings of the female. In all other species these markings agree well between male and female.

— Females 7

5. (4) Tip of superior appendage sharp with subterminally a blunt ventral tubercle, thus in lateral view bifid in appearance (figs. 34-35). Distribution: Philippine Islands. .... *L. semperi* (Selys)

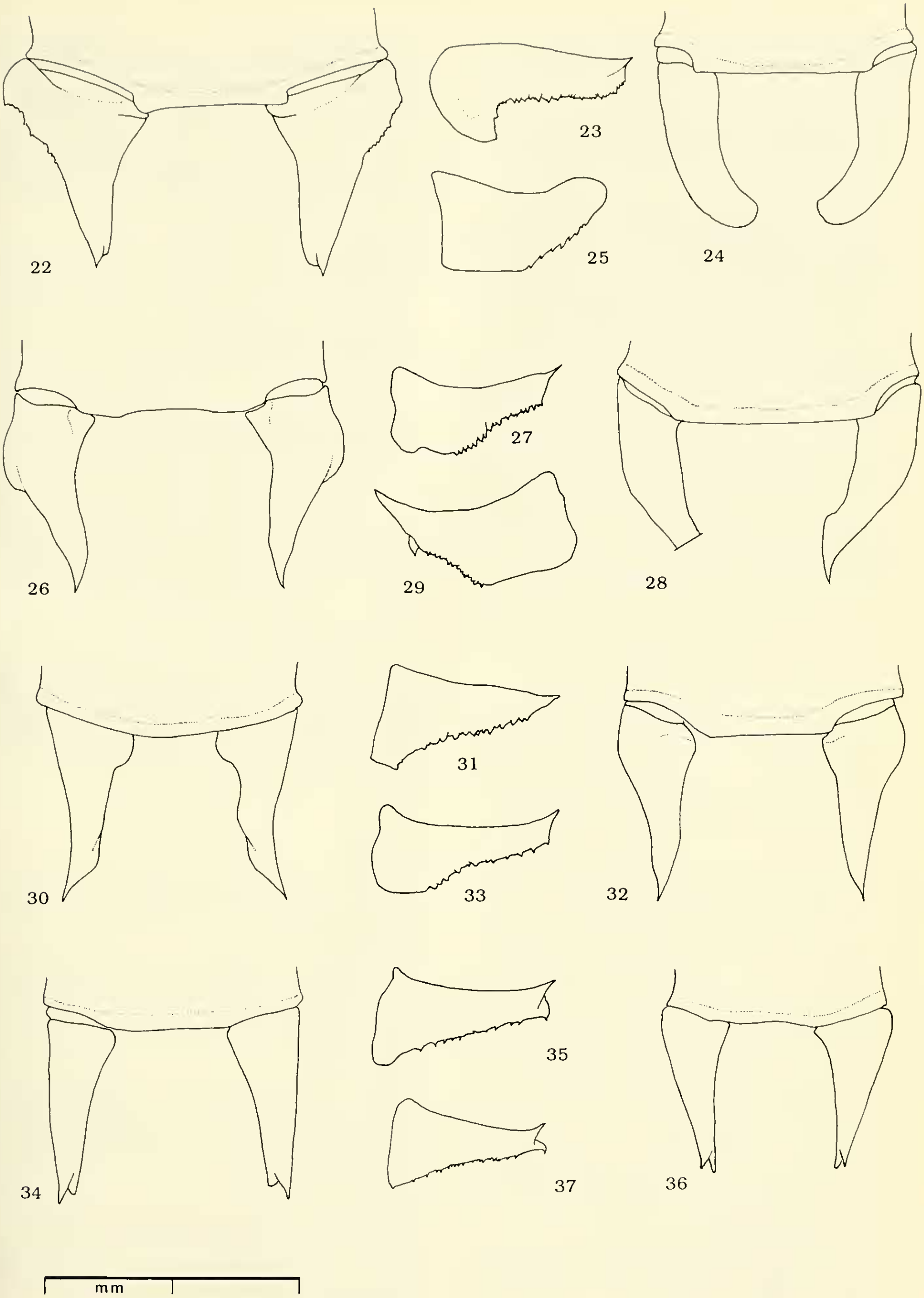
— Tip of superior appendage sharp, but without subterminal ventral tubercle 6

6. (5) Dorsal stripe (nearly) connected with mesothoracic half collar (fig. 5, 16); head pattern as in fig. 8; superior appendages of male as in figs. 32-33. Distribution: Borneo. .... *L.* cf. *pasia* spec. nov.

— Dorsal stripe and mesothoracic half collar separated by a narrow black line; head pattern as in fig. 10; superior appendages of male as in figs. 30-31. Distribution: Java and Sumatra. .... *L. lansbergei* (Selys)

Note. Specimens from Java belong to subspecies *lansbergei* and specimens from Sumatra to subspecies *assimilis*. According to Ris (1927: 28-29) the superior appendages of both subspecies are different.

7. (4) Valvula vulvae extremely long, extending to the hind margin of segment 10 (figs. 3-4); occiput without tubercles (fig. 2); head pattern as in fig. 1. Distribution: northern Borneo. .... *L. pasia* spec. nov.



Figs. 22-37. – *Leptogomphus* superior appendages of male, for all species in dorsal and lateral view respectively. – 22-23, *L. gestroi* from Thailand, Doi Suthap; 24-25. *L. risi* from Thailand, Nakhom Sithammarat province; 26-27, *L. coomansi* from E. Borneo; 28-29, *L. pendleburyi*, holotype from northern Borneo; 30-31, *L. lansbergei lansbergei* from W. Java; 32-33, *L.* cf. *pasia* from eastern Sabah, Danum Valley; 34-35, *L. semperi* from Basilan I.; 36-37, *L. palawanus* from C. Palawan.

— Valvulae vulvae much shorter, extending not further than the hind margin of segment 9 8

8. (7) Occiput with four slender spiny tubercles; dorsal stripe connected with mesothoracic half collar. Distribution: Philippine Islands. . . . . *L. semperi* (Selys)

Note. A female in the collection of the RMNH from Mindanao keys out here. I consider this specimen doubtfully conspecific with the male from Basilan I., which was compared with the type of *L. semperi* by M. A. Lieftinck (for a detailed description of the male specimen, see also Laidlaw 1936: 269).

— Occiput with ridges or smooth, but always without spiny tubercles; dorsal stripe and mesothoracic half collar separated by a narrow black line 9

9. (8) Hind margin of occiput nearly straight or with two roundish tubercles in the middle (size of tubercles showing much variation). Labrum black with a paired subrectangular pale spot (cf. fig. 10). Last abdominal segments, fig. 12. Distribution: Java and Sumatra. . . . . *L. lansbergei* (Selys)

Note. According to Lieftinck (1948, p. 245 and fig. 9) specimens from Java (subspecies *lansbergei* tend to have more conspicuous tubercles than specimens from Sumatra (subspecies *assimilis* Krüger).

— Hind margin of occiput against both eyes with an erect squarish tubercle (fig. 14). Labrum pale (creamish yellow ?) with a narrow dark stripe along the anterior margin and a very narrow longitudinal dark line in the middle. Last abdominal segments, fig. 13. Distribution: Thailand. . . . . *L. inclitus* (Selys)

10. (1) Middle of postclypeus with a yellow patch; antehumeral stripe absent or reduced to a small spot in posterior part of synthorax above humeral suture (fig. 18). Superior appendages of male, figs. 26-27. Distribution: Borneo. . . . . *L. coomansi* Laidlaw

— Postclypeus black or brownish black, without yellow markings; antehumeral stripe reduced to a larger or smaller pale spot in posterior part of synthorax above humeral suture 11

11. (10) Yellow mark on frons a single transversal stripe (fig. 9); thoracic pattern, fig. 7; superior appendages of male, figs. 28-29. Distribution: Northern Borneo. . . . . *L. pendleburyi* Laidlaw

Note. Only known from male holotype.

— Transversal pale stripe on frons divided in the middle, or at least with distinct dark triangular emarginations in the middle 12

12. Males 13

Note. The male of *L. mariae* is unknown.

— Females 14

13. Superior appendages in dorsal view curved inwards, tip bluntly shaped (figs. 24-25). Distribution: Malaysia. . . . . *L. risi* Laidlaw

— Superior appendages in dorsal view straight, tip bifid (figs. 36-37). Distribution: Palawan. . . . . *L. palawanus* Asahina

Note. Specimens from Borneo that key out here, may belong to *L. mariae*, of which the male is undescribed. See Lieftinck (1948, p. 248) for an illustration of the thoracic pattern of the female.

14. Occiput smooth, without tubercles. Distribution: Malaya. . . . . *L. risi* Laidlaw

— Occiput with conspicuous tubercles (Borneo and Philippine islands) 15

15. Area behind lateral ocelli with a sharp tubercle, directed posteriorly. Distribution: Palawan. *L. palawanus* Asahina

— Area behind the lateral ocelli with a semicircular transversal rim divided into two parts by a central depression (Borneo) . . . . *L. mariae* Lieftinck

Note. This species is only known from the female holotype. In other species with tubercles on the occiput, these tubercles may be absent or broken at one or both sides of the head.

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